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DBM HDMI Consolidated

go/xbid-hdmi-master

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PRD
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Objective

Revamp DBM bidding strategy, including fixed/opt, first/third party exchanges, via a consolidated HDMI system, for better performance and less system complexity.

Background

The current (2020Q2) status of DBM 1p Bidding is described in the following table.

	Adx	3PE
Opt	████████████████	████████████████
Fixed	• Smartbidder (Maximizing surplus, ██████████)	• Poirot.

The vision for DBM 1p bidding is to consolidate all these pieces and create a DBM HDMI core bidding suite.
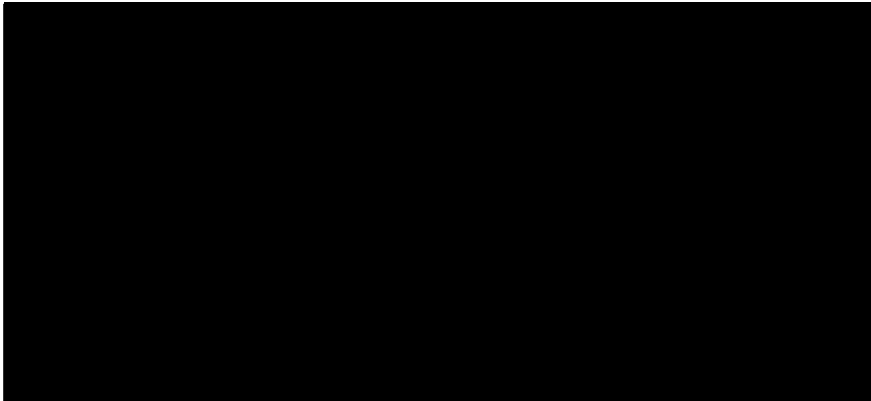
	Adx	3PE
Opt	HDMI	
Fixed		

The benefit of such consolidation is multifold:
- **Better performance**. This is especially prominent for 3PE, where bidding is largely simplified due to missing Highest Other Bid (HOB) data. In first-price auctions, prediction

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- **Less maintenance**. The consolidated bidding engine requires less maintenance for multiple systems, HDMI, SmartBidder, and Poirot.

Among the four cells, DBM opt on Adx is powered by HDMI engine already, with the fallback cases dealt with using the smart-bidder. We outline the remaining steps to migrate other cells to HDMI.

Overview

The system consists of two major components, **prediction models** (pHOB) and **bidding models** (a.k.a. HDMI); the prediction models' outputs are part of the bidding model's signals.
In the following two sections we describe them separately.
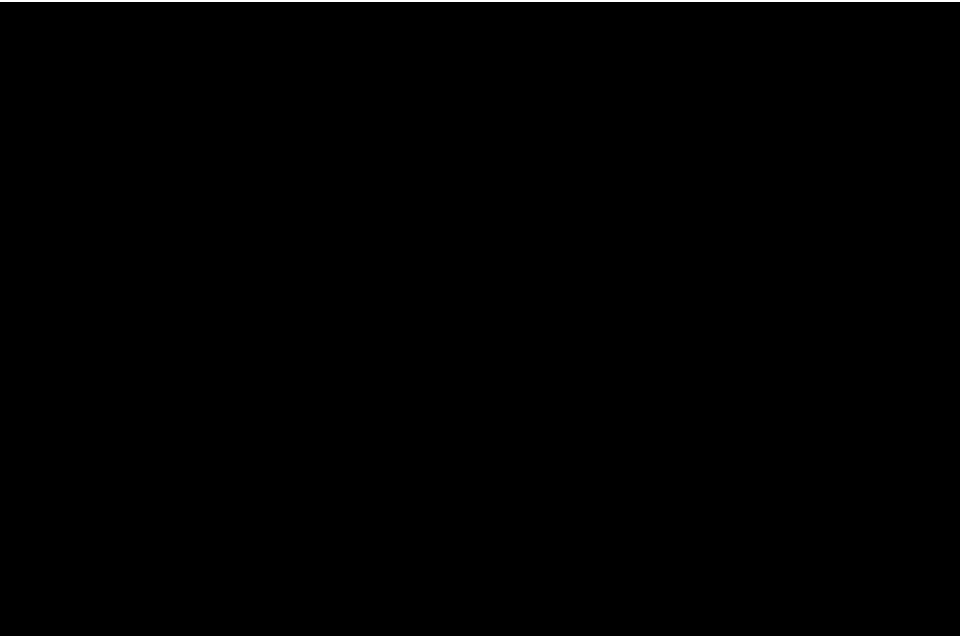
Prediction Models

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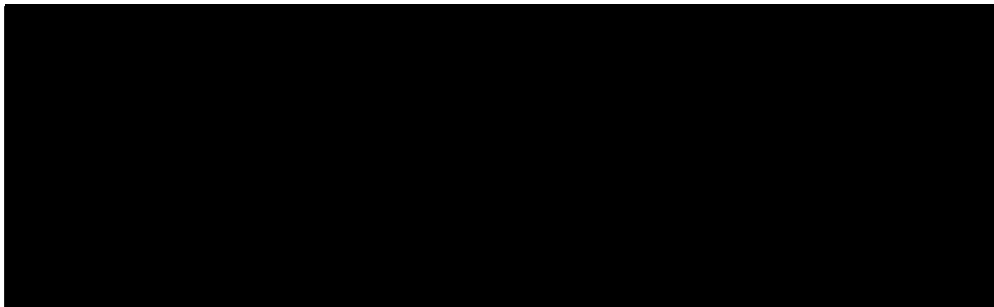
Prediction for Highest Other Bid on Adx

The model for Adx was built when Adx announced moving toward first price auction. See design doc go/phob-pear-tfx, and there has been improvement from DV3 and GDA teams thereafter.

Prediction for Highest Other Bid on 3PE

Commented [1]: @neillin@google.com @meihuixie@google.com I think this is what's gonna happen at serving time, so we don't need to extract partial sum of the feature weights at serving time.

Commented [2]: I see, thanks. This makes sense. And here b_i is actually log(bid).

Commented [3]: The implementation could be a offline transform and in serving time, we get the pHOB directly without extra transformation. @yufanhuang@google.com to check if it is possible.

Commented [4]: I remember I had a discussion with Siyuan, maybe we can directly output pHOB from TF-Pear (conversions happen within TF-Pear), but this would require additional customized component. I will further check with Siyuan.

Bidding Models

Our biddings are based on HDMI (go/first-price-bidding); the HDMI model relies on two statistical models to estimate bidding curves, i.e. **market model** and **reward model**. The implementations of them are different depending on traffic type and volume.

		Adx		3PE	
		Market	Reward	Market	Reward
Opt	Regular				
	Fallback				
Fixed					

Table: Outline of bidding models after the consolidation.

HDMI for Opt Buyers

> **Commented [5]:** @janczak@google.com I can't recall for Adx fallback cases, what reward model do we use?

> **Commented [6]:** The current opt AdX fallback levels work like:

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Adx non-fallback case is using HDMI, and the parts to be rebuilt are the 1) Adx fallback case, 2) Adx on 3PE. For 1) we defer to the next section since it uses SmartBidder built for fixed bidding handles this case and will be replaced with HDMI. We now outline the design for 2).
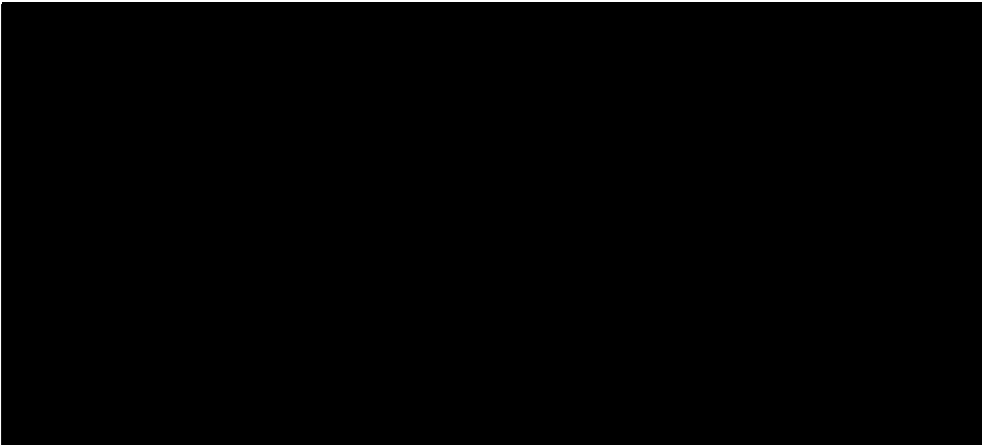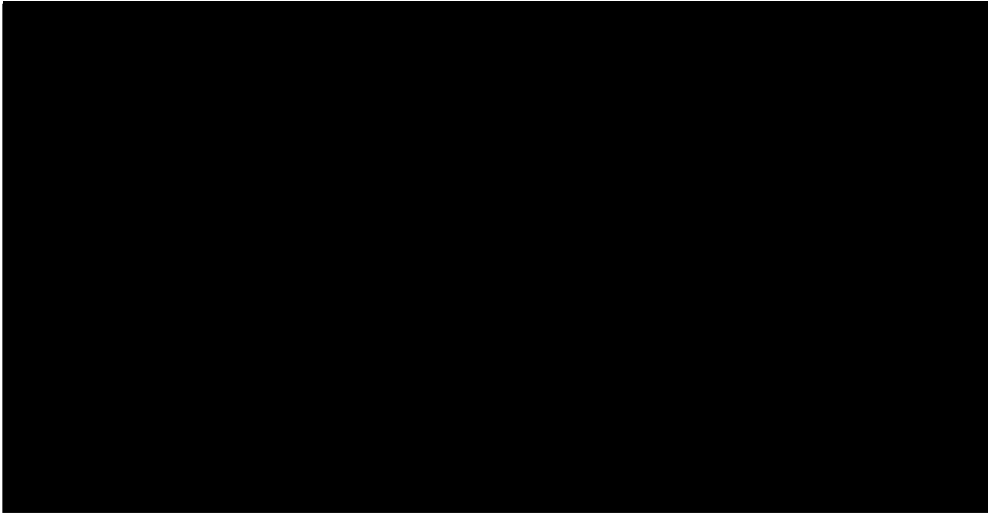
HDMI for Fixed Buyers

For fixed buyers DBM currently uses SmartBidder for bid lowering on Adx, and Poirot for network level bid lowering to maximize surplus. SmartBidder takes a value, and lowers the bid based on pHOB to maximize surplus. The same mechanism is used for Opt fallback cases, taking the second price bid as value. Similar to opt, the lack of transparent HOB on 3PE made it

impossible to make fine tuned bid shading, and we historically relied on Poirot to lower our bids on certain slices (exchange, bid bucket). Once we have the pHOB on 3PE, we can then use the same bid shading technique as Adx.

SmartBidder is a blackbox estimation for bid curves that maximizes surplus given advertiser value, but fundamentally it has similar objective function as opt favor goal type. In addition to reducing system complexity, we also expect mild performance improvement from this migration; see details in go/fixed-1p-hdmi.

Fixed buyers do not have ROI goals, hence the constraints in opt optimization are omitted. The algorithm fits perfectly into the HDMI framework, but does not require reward models to enforce ROI goals. The migration of SmartBidder to HDMI requires three steps: 1) build market model; 2) mute reward model pipeline; 3) change bid parameter generation pipeline to allow the cases when ROI goal is not needed.

Links to Detailed Design

go/dbm-3pe-phob: "DBM pHOB model for External Exchanges".